Enhanced turbocharger care from drydock-to-drydock

30 September 2020 • 09:00-09:45 BST

Webinar Q&A summary:
IL | Irina Lang, ABB Turbocharging
AM | Andrew Madge, Wilhelmsen Ship Management UK

#marinepropulsion
Has the use of VLSFO been found to improve or deteriorate turbocharger operation and TBOs?

IL | It is too early to give an indication on this as the use of VLSFO is still on the uptake. Engine and turbochargers running with VLSFO fuel need to accumulate more running hours before useable data can be collected and observations made on the influence of VLSFO fuel on the turbocharger operation.

AM | With the broad range in parameters that are possible in VLSFO this is not an easy question to answer, more time is needed to see what the industry experience is.

Is the lubricant BDN a significant factor in overall turbocharger operational strategy?

IL | All lubricating oils suitable for the engine are admissible for the turbocharger. This also applies to the lube oil BDN. Depending on the specified oils, the permissible viscosity range at the oil inlet and the temperature range are outlined in the engine builder manual.

AM | I think the question is about Lubricant BN, this has been a problem for some 4-Stroke engines operating on very low sulphur gas fuels. Although less likely, until we get the cylinder lubrication correct for the new fuels it may also cause some increased fouling for the 2-Stroke turbochargers.

Irina: Will the maintenance of turbochargers vary depending on type of fuels and gas? Any expectations/R&D's on future fuels?

IL | The exchange of wear & tear parts may vary depending on the fuel type. In general, the decision to replace the parts depends on the condition of the wear & tear parts.

AM | If we assume that the materials do not change, I would expect vessels using cleaner fuels now and in the future will be able to achieve longer component life. Bearing life would likely not be affected by the fuel in use so this will only improve through design improvements unrelated to the fuel.

What impact will new turbocharger emissions reduction technologies have on both fuel/consumption thermal efficiency and on the maintenance costs and intervals of both the turbochargers and diesel engines?

IL | This highly depends on the measures taken and is not that easy to answer. However, the maintenance costs of the TC should not be affected by any measures.

AM | The Otto cycle relies on good air delivery for correct mixing of the fuel and combustion air. Diesel engines also need good air delivery for efficient operation, with the increasing focus on carbon emissions and black carbon the turbocharger has a key role to play. For some fuels maintenance intervals may increase, but if turbocharger performance/efficiency becomes more critical it may reduce for other fuel types.

New technology is rarely cheaper than the old, but as the technology improves and gains market share, costs will reduce.

What is the estimate turbocharger efficiency loss for late overhaul? How do we take calculate the total cost saving / lost based on efficiency?

IL | Late overhaul may lead to increased contamination of parts and a corresponding efficiency loss of the TC. The exact efficiency loss depends on the amount and type of contamination (removable by dry-cleaning?). Reduced TC efficiency leads to higher fuel consumption.

AM | You can request up-to-date formulas from the engine maker for your specific engine, but one calculation suggests that a 0.1 bar drop in scavenge pressure could result in a result 3 bar drop in Pcomp. Additional to the drop in Pcomp, exhaust temps may increase raising the thermal stress on other
components in the engine.

**Do you still maintain drydock maintenance or do you plan / adapt it according to real asset condition?**  
**IL** | Yes, the traditional drydock maintenance schedule is kept. The wear & tear parts are exchanged based on their actual condition.  

Andrew: with regard to turbocharger failure, what are the main causes that keeps you awake at night?  
**AM** | Turbocharger reliability has improved greatly since I first sailed, but my first concern would be tracking the running hours of individual parts or the SIKO components through the full lifecycle. Most equipment makers have expected lifetimes for the various parts and without good record keeping these can be difficult to track.  

**What are the key parameters to be monitored in order to keep the Turbocharger in optimum condition?**  
**IL** | For assessing the health of the turbocharger, amongst other parameters turbocharger speed, turbine inlet temperature, engine load & speed, charge air pressure.  
**AM** | With the of the ISO correction factors, you can compare the performance of the turbocharger on the test bed to the actual conditions seen. The key parameters are generally recorded on shop test and should be available to everyone.  

Barometric / Engine Room pressure depending on air intake type  
Pressure drop across the intake filter and air cooler  
Turbocharger speed  
Air inlet and outlet temperatures  
Exhaust gas inlet and outlet temperatures  

**The huge amount of data transfer from ship to shore remotely provide a huge challenge in terms of connectivity, consistence not to mention cyber security and costs. How to overcome these issues?**  
**IL** | There are different ways of sending the data from vessel to shore, the more automated ways require investments and constant connectivity. There is also a manual method that consists of a simple extraction of the data from the on-board automation system that requires no additional investments. Cyber security concerns are addressed by the use of secure connection and safe encrypted data storages (ABB uses Microsoft Azure Technologies).
Talking about the fixed cost maintenance, do both of you think that it is a must to have a good digitalization capability by the turbocharger service provider / manufacturer? Or what do you think the main capability drivers for fixed cost maintenance?

IL | Yes, digital capabilities are required in order to optimize costs, ensure reliability and uptime while at the same time being able to provide additional values such as the health overview for a complete fleet.

AM | To get the best value for money out of these fixed cost contracts better understanding of how the equipment is being operated and the actual conditions it is exposed to is important. This information can be used when evaluating the physical condition of the parts at overhaul, allowing better prediction of component life expectancy and when parts should be renewed.

It was mentioned that data monitoring is important. Kindly share how this will be carried out.

IL | The required data is already available on board of most vessels, as they are required in the automation system. There are different ways of sending the data from vessel to shore. The automated way is e.g. via cloud-to-cloud, where the data will be analyzed in the ABB cloud. Another option is manual extraction of the data from the automation system that is then sent to ABB via email where it will be analyzed.

Main failures of modern turbochargers?

IL | The possible failures highly depends on the application and on the usage and condition of the turbocharger.

How to deal with the price oriented clients? mainly in my country for shipping company price comes first over the quality, down time and warranty?

IL | Also for cost sensitive customers, a fixed price combined with additional values might be interesting as it will pay out in the long run. Clearly, if those customers are looking at short term low costs, it is a challenge.

Will Turbo Marine Care customers have better access to technical backup from ABB?

IL | All customers will have equal access to technical backup. Processes for Turbo Marine Care customers will however be faster, as the commercial terms are already settled and agreed within the agreement.

Apart from monitoring turbocharger parameters, Do you see value in capturing variation in user behavior through these parameters as an important element that should be monitored for Turbicharger care?

IL | Yes, besides the absolute value of the monitored parameters the variations over time are very important to draw conclusions on the turbocharger health.

AM | There can be big variations in sister ship performance and machinery failures, by tracking and trending these variations best practices can be identified and shared. In the event of a failure these variations could provide clues to the root cause.
As data is the heart of the digitalization who owns the data in your model?
IL | The data ownership is with the customer and stays with the customer.

What can be optimised on the turbocharger to improve performance?
IL | Regular cleaning in operation of the TC (turbine end, f/s) but as well e.g. the CAC (pressure loss!) or the turbine end protection grid as they might lead to pressure losses which might affect performance.

AM | The ship design stage is where the best improvements can be made. Look at the air supply to the turbocharger, taking the air from outside the ER can show improvements in the SFOC. Low resistance air coolers, Ensuring good clean, cool uniform air flow into and out of the turbocharger is important. Similarly for the Exhaust gas the lower the back pressure on gas outlet the better.

Separate oil supply circuit with good fine filters can extend the bearing life.

Inservice your option are much more limited, but maintaining clean air filters and coolers will help, as will keeping the lub oil in good condition and within the OEM limits will help meet expected bearing lifes.

Your dock to dock model works only if owner plan the docking timing in respect to your offer. What will be the offer if owner just finished the docking?
IL | If the service was done with ABB, such customers can commit for the next drydock and receive a warranty after agreement signature and data transmission started.

How is the field experience on 2 stage Turbocharging?
IL | With respect to the topic of fixed price for drydock-to-drydock, it is applicable to low speed two-stroke turbochargers. Two stage turbochargers are used in medium and high speed applications.

Washing with water is not best. Why was never implemented the washing cycle with crushed nuts or rice?
IL | Dry cleaning is the standard method recommended for cleaning the two-stroke turbochargers

AM | Some makers recommend only dry washing, others recommend a combination of wet and dry. Both can be effective if done as maker instruction.

In your opinion, would monitoring usual control parameters alone (pressure, temperature, RPM and Load etc) be sufficient for verifying the health of the turbocharger? Would other aspects need to be monitored as well?
IL | Additionally, certain parameters from the engine are required as well. A challenge is for example also the lub oil quality as this can become critical for the TC operation.
Yes, the parameters normally recorded at Shop Test and daily are sufficient to monitor the efficiency of the turbocharger. Oil condition and vibration monitoring can complement these and offer additional information to the mechanical condition.

**Which turbocharger signals are tracked?**

For assessing the health of the turbocharger, amongst other parameters turbocharger speed, turbine inlet temperature, engine load & speed, charge air pressure are tracked.