

## Service Information    No. 04 / 06

Date: 28.06.2006

### **Piston burn    inspections/measures**

**M 43**

An essential prerequisite for trouble free and economical engine operation is an optimized combustion of the fuel. The express aim is to burn the fuel as completely as possible and with smallest possible ignition delay.

Upon shipment our engines are optimally adjusted in this respect and the relevant components are designed to give long service life. Under severe operating conditions on board this "ideal" status, however, will show a deteriorating trend due to various reasons. As long as this process remains within the normal expected scope, satisfactory engine operation without major trouble can be assumed between the practice oriented overhaul intervals.

However, in the past damages unfortunately also affected the pistons which were essentially attributable to the fuels used and the condition of the lubricating oil. These operating conditions were the reason why the expected service life values were not reached. In exceptions, however, even major engine damage occurred.

In these cases particularly the pistons were affected by burn in the combustion bowl of the piston crown. Our investigations have revealed certain coherences in this respect, but their individual significance is difficult to assess.

These damages showed different kinds of deposits on the top and also in the shaker chamber of the piston crown. These deposits led to local material overheating with disproportionately high material erosion which, in individual cases, even led to break through into the cooling oil chamber. The reasons for this process were:

- Fuels especially with high asphaltenes content.
- Inadequate fuel treatment.
- Improperly opening, leaking injection nozzles.
- Charge air pressure too in relation to the power output.
- Lubricating oil parameters partly below or exceeding the specified limits.

**The intention of this Service Information is to provide you with additional notes on this issue.**

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#### Ignition behaviour and asphaltenes

The ignition behaviour of a fuel as well as the asphaltenes content are difficult to determine and not part of its standard examination. However, it is possible to use the CCAI value as an indicator of the ignition behaviour. Asphaltenes, especially in combination with a high content of aromatic compounds, are more likely to have a poor ignition quality.

We, therefore, recommend to use only fuels with low asphaltenes content that have a CCAI value that is **clearly** within the permissible range as defined by our fuel specifications.

#### Fuel treatment

When fuels partly reach the limits particular attention should be paid to their treatment. Please refer to the Caterpillar operating media regulations.

#### Nozzles

A good combustion essentially requires a proper condition of the nozzles. As it is not always possible to recognize poorer fuel grades, it has to be expected that especially the injection nozzles will be subject to higher wear rates. We, therefore, recommend to rather adopt a condition-based maintenance approach and, in case of doubt, replace the nozzles before the normal due date.

#### Turbocharger condition

The operating data of the turbocharger should be checked and evaluated on a regular basis. The values of charge air pressure, compression temperature of the air and turbocharger speed directly depend on each other. If, in conjunction with the exhaust temperatures, bigger deviations from normal condition should be ascertained, possible irregularities are to be remedied as quickly as possible.

#### Lubricating oil condition

Deposits in the shaker chamber of the piston are essentially forming when the quality of the lubricating oil is poor. In this connection particular care has to be taken to ensure that all values specified in the Caterpillar operating media regulations are met. (TBN; Viscosity; Density)

In case of deviations it is absolutely required to replenish the lube oil charge with new oil. As specified in our operating conditions, at least 25% of the total oil charge will then have to be exchanged.

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#### **Piston inspections**

The inspections of individual pistons are at any rate to be carried out in accordance with our operating instructions and should also take place if only the cylinder head is removed. If the 7,500 hours inspection should reveal increased burn, further pistons are to be checked. Furthermore, future inspections of these and further pistons are required at shorter intervals in coordination with your responsible dealer.

For checking the combustion bowl geometry a template should be used. This template can be made on board or ordered from Cat.

Furthermore, we are working on a tool that will also enable checking of the condition of the piston surface through the nozzle hole.

If an endoscope is available on board, it can also be used to carry out a visual check of the combustion bowl each time a nozzle is exchanged.