

## **Service Information No. 13 / 04**

**Date:** 05 - Jan - 2005

### **KBB Turbocharger KBB Service Information S 048**

**M20 / M25**

**Subject:                   Wear of the turbine nozzle ring during heavy fuel oil (HFO)  
                                  operation**

**Valid for TC type:    R3-2, R4-2, R4-3 and R5-3**

The KBB turbochargers used on M20 and M25 engines have radial exhaust turbines.

This type of turbine has a naturally higher wear rate on the nozzle rings than axial turbines. The wear rate depends on the amount of solid particles in the exhaust gas. This means that the quality of the used fuel has a big influence on the wear rate of the nozzle ring. The engine operating data indicates the wear condition of the nozzle ring.

The attached KBB service information gives an additional guideline for the exchange of nozzle rings.

Subject: Wear of the turbine nozzle ring during heavy fuel oil (HFO) operation  
Valid for TC type: R3-2, R4-2, R4-3 and R5-3  
Valid for engines: All

## **WEAR ON THE TURBINE NOZZLE RING DURING HEAVY FUEL OIL (HFO) OPERATION**

The combustion of heavy fuel oil (HFO) results in increased wear of the exhaust gas turbocharger components and particularly of the turbine.

Wear is caused by erosive particles in the exhaust gas that can only follow the exhaust gas flow to a limited extent due to their mass inertia.

Since the centrifugal force counteracts the exhaust gas flow, wear becomes most obvious on the nozzle rings of radial turbines.

Wear depends on various factors which can differ considerably.

### **Wear factors**

Wear is determined by the following factors, among others:

1. HFO quality / HFO composition  
The HFO composition can differ considerably even if the viscosity is the same. The HFO constituents can vary widely within the permissible maximum limits.  
Viscosity is not the sole quality characteristic.
2. Combustion quality  
When the combustion is bad, more exhaust gas particles are produced that cause increased wear.  
Since the combustion quality depends on the state of the engine system including the exhaust gas turbocharger, all specified maintenance work has to be carried out according to the manufacturer's instructions.  
Deviations and troubles have to be eliminated immediately.
3. Operating regime  
Permanent or longer operation at a low output should be avoided since the combustion quality is worse at a low than at a high output .  
It is preferable to operate a few engines at a high output in multi-engine applications.
4. Cleaning the turbine  
The particles which are loosened by the injected water are an additional stress with regard to wear. Cleaning too often should be avoided as should cleaning too seldom because a dirty turbine leads to bad combustion due to a low efficiency.

## Wear on the nozzle rings

The nozzle ring is subjected to increased wear during HFO operation and is thus a wearing part.

The life time of the nozzle ring is approximately 12,000 hours and depends on the HFO quality and the operating conditions.

Wear becomes obvious through a change in the exhaust gas temperature and charge air pressure. The more advanced the wear, the greater the rise in the exhaust gas temperature and drop in charge air pressure.

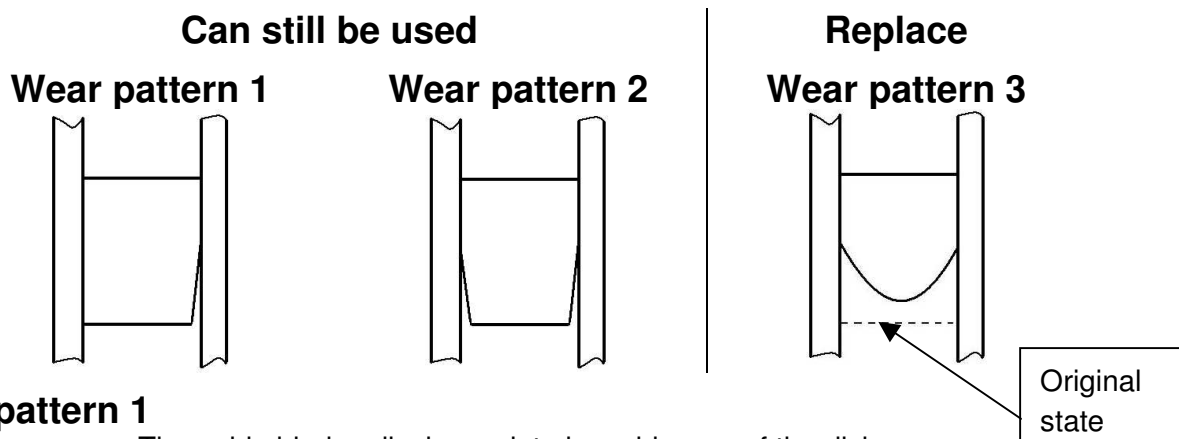
Advanced wear of the nozzle ring is indicated, for example, through a rise in the exhaust gas temperature of around 30K - 40K and a drop in the charge air pressure of 0.2 bar.



**However, other factors can also be responsible for a change in the exhaust gas temperature and charge air pressure!**

Irrespective of the foregoing, the exhaust gas temperature limit values (after the cylinder) specified by the engine manufacturer may not be exceeded.

Wear mostly affects the guide blades and can progress as follows:



### Wear pattern 1

- The guide blades display a slot alongside **one** of the disks.
- The nozzle ring can still be used if the slot length is < 25 mm and the slot width < 6 mm.

Under the above-mentioned conditions the nozzle ring is not considered to be worn to such an extent that it needs replacement and can thus continue to be used.

### Wear pattern 2

- The guide blades display slots alongside **both** disks.
- The nozzle ring can still be used if the slot length is < 25 mm and the slot width < 4 mm.

Under the above-mentioned conditions the nozzle ring is not considered to be worn to such an extent that it needs replacement and can thus continue to be used.

### Wear pattern 3

- The guide blades show **deep** slots alongside both disks **and** the outlet edge of more than two of the guide blades is completely worn.

The nozzle ring **must** be replaced.