Market Update Note
28 November 2013

ME-B.3 Engines with Variable Exhaust Valve Timing

With the introduction of ME-B8.3/9.3 (Dot 3) engines, the ME-B8.2/9.2 engines have become obsolete and have been removed from the engine programme.

This means that the Dot 3 design has been applied in new design specifications ordered since the beginning of 2013.

Compared with Dot 2, the two key features of the Dot 3 design are the shorter exhaust cam and the variable exhaust valve timing, which improves fuel efficiency at part load by means of flexible compression pressure control.

![Fig. 1: Lower fuel consumption at part load for ME-B.3 with variable exhaust valve timing](image-url)
Dot 3 engines can use the timing unit during the start-up sequence to increase the engine acceleration capability. This is done by activating the timing unit when the exhaust valve starts closing. By doing so, the exhaust valve is kept open, and compression pressure build-up is prevented.

The working principle is as follows: The shorter Dot 3 exhaust cam has the effect that the exhaust valve closes earlier at part load, which leads to an increased compression pressure. The increased compression pressure allows the engine to run with a higher maximum cylinder pressure, which again results in a lower SFOC.

In order to keep the maximum pressure within the design limit, the timing unit is activated at high load. The timing unit adds a fixed amount of oil to the hydraulic push rod for the exhaust valve after it has started its closing sequence. This means that the exhaust valve opening period is extended and the obtainable compression pressure is reduced.

![Fig. 2: Exhaust valve opening with active timing unit](image-url)
Engine operation at low load:
No activation of timing unit
→ “short cam”
→ early closing of exhaust valve
→ increased $p_{\text{comp}}$

Engine operation at high load:
Activation of timing unit
→ “short cam” + hydraulic delay
→ delayed closing of exhaust valve
→ decreased $p_{\text{comp}}$

Fig. 3: Exhaust cam profile

The new design comprises the following modifications:

1. A new HCU because the ELFI-B valve will be exchanged with a new ELFI-V valve. The ELFI-V valve controls the fuel injection and the timing unit for the exhaust valve.
2. Two pipes for connection of hydraulic oil from the HCU to the timing unit.
4. New ME-B software for engine control system with MPC.

If you require more information, do not hesitate to contact department LES – Design of Small Bore Engines at LES@mandieselturbo.com.

Yours faithfully

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