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10 years of MaK VRT pressure charging: Variable turbine geometry optimises torque and reduces emissions

Hamburg, Germany – One of the most powerful tugs in the port of Hamburg has just celebrated its 10th anniversary – along with the innovative MaK VRT technology that has been part of her equipment since she went into service. The harbour tug “Michel”, owned by Petersen & Alpers, was commissioned in 1998. She owes her capacity to a well-coordinated crew and a twin-engine propulsion plant consisting of two medium-speed MaK 8 M 20 engines adjusted to 1,520 kW at 1,000 rpm and equipped with a Variable Radial Turbine (VRT). So, not only Michel but also MaK VRT technology has stood the test of time, particularly in tug applications.

The capacity of marine diesel engines has increased steadily over the years. One of the methods chosen to achieve this was to continuously raise mean effective pressures. Unfortunately, the high-efficiency turbochargers used to do this cannot always sufficiently cover the air requirement of the engine in the part load range, which in turn results in torque losses and thermal overload. Torque weakness has a particularly negative effect on towage since tugs are often equipped with fixed-pitch propeller plants running at continually changing speeds.

MaK came up with a solution actually adjusting the engine’s turbine during operation as early as the 1980s. Called Variable Multi Pulse (VMP) technology, it was used in the MaK M 332 C engine with axial turbine, particularly on tugs. When the new MaK long-stroke generation was launched from 1992, VMP technology was developed into VRT technology and adjusted to the KBB turbocharger models with radial turbine used for the M 20 and M 25 engine series.

The basic principle of VRT is as simple as it is convincing. The nozzle ring in the turbocharger consists of two parts with different cross sections (full load ring and part load ring). Depending

on the engine load, either one or the other ring can be activated. The changeover between the two is fully automatic and affected by means of compressed air depending on engine speed and charging pressure. The nozzle ring simultaneously acts as an air cylinder, which eliminates the need for a complex adjusting mechanism.

After Michel became the first vessel to be equipped with this technology in 1998, many other tugs were provided with MaK engines types 8 M 20 and 8 M 25 that included the VRT technology. Daily use fully confirmed the expected improvements in torque characteristics and ramp-up behaviour. Further advantages are low thermal load on the engine, reduced exhaust emissions and low fuel consumption. The heavy fuel compatibility of VRT technology has also been proven in practice.

It only remains, then, to answer the question why Michel is no longer the toughest conventionally driven tug in Hamburg, despite her optimal MaK engine technology. It's because Michel got a bigger brother, "Peter", in September of last year. It goes without saying that this tug is also equipped with engines from Caterpillar Marine Power Systems (CMPS). Only this time, two high-speed engines Cat[®] 3516B were installed, each of 2,090 kW at 1,600 rpm.

Regardless of whether MaK or Cat marine engines are used, ship operators across the world swear by their power, reliability and longevity. Technical innovation is an integral part of the product philosophy as the market launch of MaK VRT technology confirmed in 1998 – at a time when competition was still looking for viable problem solutions to improve ramp-up behaviour, engine emissions and fuel consumption.

Characters: 3,604

Pictures available on request:

- 1.) Tug "Michel" with two MaK 8 M 20 engines**
- 2.) MaK 8 M 20 marine engine with VRT**
- 3.) Tug "Peter" with two Cat 3516B engines**
- 4.) Cat 3516B marine engine**

About Caterpillar Marine Power Systems

Caterpillar Marine Power Systems, with headquarters in Hamburg, Germany, groups all the marketing and service activities for Cat and MaK marine engines within Caterpillar Inc. The organisation provides premier power solutions in the medium- and high-speed segments with outputs from 93 to 16,000 kW in main propulsion and 10 to 7,680 kWe in marine generator sets. The sales and service network includes more than 2,100 dealer locations world-wide dedicated to support customers in ocean-going, commercial marine and pleasure craft wherever they are.

More information is available at: www.Marine.Cat.com.

About Caterpillar

For more than 80 years, Caterpillar Inc. has been making progress possible and driving positive and sustainable change on every continent. With 2007 sales and revenues of \$44.958 billion, Caterpillar is a technology leader and the world's leading manufacturer of construction and mining equipment, clean diesel and natural gas engines and industrial gas turbines.

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Editorial information:

Ronald Brüggmann

Manager Media Relations

Caterpillar Marine Power Systems

Phone: +49 40 2380-3104

E-mail: Bruegmann_Ronald@Cat.com

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