

# Heading for 30 000 Operating Hours on HFO GenSets

## Contents

**Engine focus**

**Time between overhaul**

**Customer feedback**

**Main particulars of the vessels**

**The vessels' trade lanes**

**Perfect condition - low wear rates**

**10 years and 30 000 hours**

**Programmed maintenance  
- and focused operation**

**Bunkering and fuel politics**

**Fuel oil treatment**

**Lube oil treatment**

**Original spares**

**Maintenance costs**

**Conclusion**

**About CP Ships**

**Appendix -  
Service report, calibrations / wear rates**

## Heading for 30 000 Operating Hours on HFO GenSets

CP Ships (UK) Limited has achieved a very promising 24 000 hours operating interval with MAN B&W Holeby L28/32H GenSets, and the owner is now heading for 30 000 hours before the main overhaul.

*“....James, these pictures are from the No. 5 cylinder unit of No. 3 auxiliary engine on Canmar Courage. The ship is seven years old, the engine has run 24 441 hours since new and has never been opened up. We took a look at one unit to gauge if we could extend the running hours to 30 000 when I believe the main bearings should be inspected. The fuel is 380 cSt and quality is controlled through full analysis before it is put to the engine. Lube oil is analysed every 3 months, frequently separated and always maintained within specification....”*. The wording is an extract from an e-mail, submitted by Technical Director of CP Ships, Mr. Paul Siddons - to our MAN B&W London General Manager, Mr. James West.



Fig. 1: CP Ships '96- and '95-built 2200 TEU container carriers *M/V Canmar Courage* and *M/V Canmar Fortune* – supplied by Korean Daewoo Heavy Industries

### Engine focus

For any engine, the time between overhaul (TBO) is a constant focus for the designer and for the operator. The operator seeks the longest possible intervals, with due respect to the initial investment and without having to spend too much on the daily service costs. Also, the engine designer seeks to obtain the longest possible overhaul intervals, with due respect to market competition, design tools, procurement and manufacturing costs.

### Time between overhaul

MAN B&W Diesel A/S, Holeby – a MAN B&W division, which is focusing their resources on Heavy Fuel Oil burning Generating Sets for the 450-4000 kW range, is usually relative

conservative with the specification of overhaul intervals. In order to cater for any possible real-life operation condition, instruction manuals and maintenance manuals prescribe an interval of 16 000 hours. But, how far can this be extended?

### Customer feedback

As indicated above, MAN B&W Holeby recently had a splendid opportunity to obtain some customer feedback on their successful and proven L28/32H GenSet design. The London-based company CP Ships reported very promising results based on GenSet inspections and status taken at 24 485 operating hours onboard the *M/V Canmar Fortune* and at 24 441 hours onboard the *M/V Canmar Courage*.

### Main particulars of the vessels

|                   |   |
|-------------------|---|
| Name:             | Canmar Courage/Canmar Fortune   |
| Size:             | 34 330 DWT<br>33 735 GRT  |
| Type:             | Containers vessel with reefer plugs   |
| Capacity:         | 2200 TEU  |
| Building m/year:  | 2/1996 & 12/95  |
| Length oa:        | 216.00 m  |
| Width:            | 32.20 m   |
| Draught, loaded:  | 11.00 m   |
| Service speed:    | 20 knots  |
| Flag:             | Bermuda   |
| Shipyard:         | Daewoo Heavy Industries, South Korea  |
| Main engine:      | Sulzer two-stroke   |
| Auxiliary engines | MAN B&W Holeby GenSets<br>2 x 9L28/32H GenSets and 1 x 6L28/32H<br>Cylinder rating: BHP/210 kW at 720 rev/min |

### The vessels' trade lanes

Canmar vessels: *Canmar Fortune* and *Canmar Courage* are identical sister vessels in the Transatlantic service for CP Ships. The vessels are operating in a service with quick round trips between Montreal and Europe, in a total of about 18 days. Departures from Montreal are scheduled for Thursdays, and expected to arrive at Antwerp, Belgium 8 days later and in Hamburg, Germany 9 days after leaving Montreal. Departing Hamburg on Sundays, the ships return to Montreal 8 days later on Mondays. The ships will be in Montreal three nights before departing again for Europe. Port times in Europe are usually short, sometimes 6 to 12 hours.

### Perfect condition – low wear rates

Next GenSet stop will be at approx. 27 000 hours, where another cylinder unit will be opened up. Paul Siddon's conclusion after the 24 485 hours inspection: "Wear rates for the liners seem to be practically nothing. PERFECT CONDITION. Weakest parts, and therefore governing the intervals seem to be the exhaust valves". See below pictures from *Canmar Courage*, and the Service Report from *Canmar Fortune* in the appendix.

### Cylinder head



Fig. 2: Cylinder head cleaning



Fig. 3: Exhaust valve spindles

### Piston withdrawal



Fig. 4: Piston with rings



Fig. 5: Piston without rings

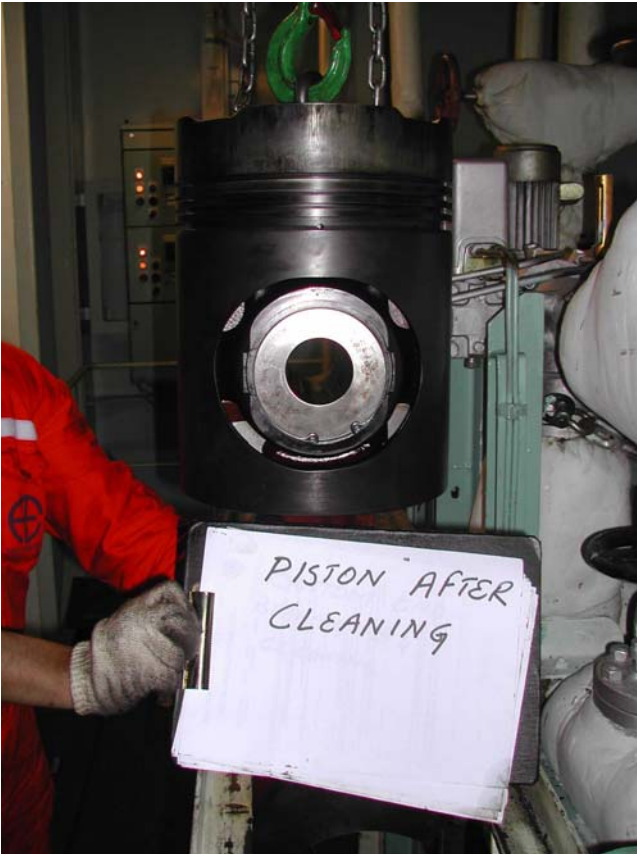


Fig. 6: Piston after cleaning



Fig. 7: Piston with new rings ready for installation

### Cylinder liner

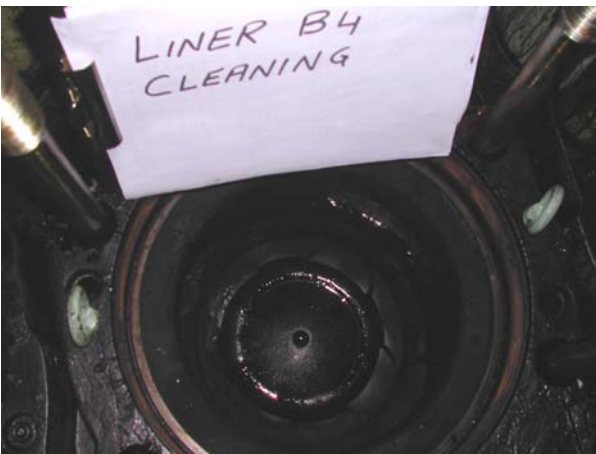


Fig. 8: Cylinder liner in block before removal

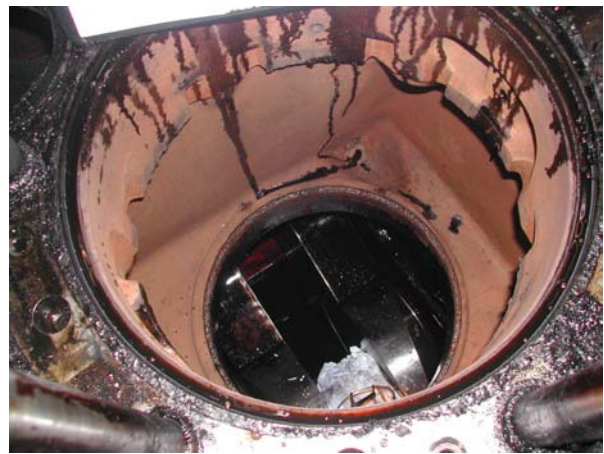


Fig. 9: Cooling water space – liner removed



Fig. 10: Cooling water-side of cylinder liner. Cylinder liner O-rings for the cooling water spaces were renewed after inspection and cleaning

### Liners after cleaning and honing



Fig. 11: Cylinder liner after cleaning



Fig. 12: Cylinder liner after the honing process

### Piston pin and con-rod



Fig. 13: Piston pin removed for calibration



Fig. 14: Connecting rod cleaned and assembled for calibration measurements



Fig. 15: Connecting rod bottom-end bearing dismantled and cleaned before dye checking.

Fig. 16: Bearing shells ready for fitting

If the pulled cylinder unit looks good at 27 000 hrs, then Paul Siddons will be confident in continuing the operation to 30 000 hrs, where a complete overhaul will be carried out. This is expected to take place at the end of this year – with assistance from MAN B&W Høleby superintendents.

### **10 years and 30 000 hours**

This means that CP Ships plans to continue with these ships for 10 years and 30 000 hours... This is possible with the ships' load pattern – where 1 of the 3 GenSets onboard is normally sufficient powerwise for the ships hotel load and the reefer containers.

Consequently, the GenSets are loaded at approx. 75-80% of MCR. Two of the GenSets are continuously running on 380 cSt HFO, whereas the third standby set is held on MDO. The third GenSet is only in operation for the additional bow thrusters power during harbour manoeuvring.

In order to even out the operating hours on all three sets, the power tasks for the GenSets are changed and turned around for each vessels' round-trip.

### **Programmed maintenance - and focused operation**

Paul Siddons stated, "We are very satisfied with the results, because we are practically doing nothing extraordinary with the GenSets. The engineers and crew members operate all engine room equipment together with the vessel's other technical installations on deck and in the accommodation in accordance with the daily trade of the vessel. All service and maintenance is carried out after CP Ships' programmed maintenance system for all technical installations onboard."

He continued, "In one area however, we are a little religious, and that's with regard to oil. The fuel and the lube oil put into our engines".

### **Bunkering and fuel politics**

The quality has to be good and consistent. Sulphur content is usually kept below 3.25%. The fuel is always carefully handled and monitored during operation and, most importantly, during the bunkering. Due to the round trips of the vessels, the bunkering of fuel is always carried out in Antwerp, Belgium by one and same supplier, and tightly controlled before its lead to the engines.

The vessels are normally bunkering about 12 000 tons of fuel, in due time, when still having a quantity of 600 tons of 'analysed and known' fuel left in the bottom tanks. Bunker samples are immediately forwarded to a lab in New York, USA and analysed with the results swiftly reported back to the ship and Paul Siddons' Technical Organisation within 3-4 days – that means before the new fuel is lead to the engines.

### **Fuel oil treatment**

The onboard fuel system is of a standard design, with a Boll & Kirch fine filter fitted before the GenSets. The fuel is preheated/centrifuged, viscosity-controlled and heated carefully and everything is strictly kept to fuel specifications and MAN B&W's injection and atomisation recommendations.

Fuel valves and injectors are regularly checked, tested and adjusted with onboard test equipment.

### **Lube oil treatment**

The GenSet lube oil is purified during the daily working hours when the engine room is manned. Oil change is carried out at 4500 hours of operation, as per recommendation.

### **Original spares**

With regard to spare parts procurement, CP Ships report that only original parts are used. “No ‘grey spares’ for our engines”; says Paul Siddons.

### **Maintenance costs**

Without revealing specific figures, Paul Siddons claims that the company has been saving a lot of money. The company’s Repair & Maintenance budget has been steady, and approximately at the same level for 7 years. And this is in a situation where the wages have gone up – following the general development in economics. The conclusion is that the total costs of consumables (spare parts and lube oil) have been reduced accordingly over the same period of time.

### **Conclusion**

Paul Siddons was very satisfied with the condition of all parts investigated at 24 000 hours. “We are carefully looking after the fuel and lube, otherwise we do nothing special”

The engines have never been opened up in our period of responsibility, and have been operating without any problems to our satisfaction. When this is said, it has to be mentioned that the camshafts have been changed by MAN B&W Holeby engineers during the guarantee period – since a bad batch of shafts, not sufficiently surface hardened, showed too high wear rates.



Fig. 17: Pleased with the GenSet situation!

A shot from the reception of CP Ships (UK) Horley premises in St. Lawrence House – showing Technical Director of CP Ships, Mr. Paul Siddons (right) and General Manager of MAN B&W Diesel, London, Mr. James West (left) at the Canmar Courage ship’s model.

### About CP Ships

One of the world's leading container shipping companies, CP Ships provides international container transportation services in four key regional markets: TransAtlantic, AustralAsia, Latin America and Asia. Within these markets, CP Ships operates 35 services in 22 trade lanes, most of which are served by two or more of its seven readily recognized transportation brands: ANZDL, Canada Maritime, Cast, Contship Containerlines, Italia Line, Lykes Lines and TMM Lines. CP Ships has a fleet of 89 ships and 413 000 teu in containers. Its annual volume is 2 million teu, more than 80% of which is North American exports or imports. It also owns Montreal Gateway Terminals, which operates one of the largest marine container terminal facilities in Canada. For further information, visit the CP Ships website: [www.cpships.com](http://www.cpships.com).



#### History – a long Canadian Pacific pedigree

Just three weeks after Canadian Pacific Railway's first train crossed the continent in 1886, it picked up more than one million pounds of tea on the Canadian West Coast near Vancouver for delivery to Hamilton, Toronto and New York.

The tea had been carried from Asia by the 800-ton sailing ship WB Flint, the first ocean-going ship chartered by Canadian Pacific. It was the beginning of CP Ships.

CP Ships has been serving Transatlantic trade lanes since 1903.

tok/ 22/9-2003

## Appendix

### Service reports / Wear rates / Calibrations

*M/V Canmar Fortune*

#### AUXILIARY ENGINE NO. 3 UNIT NO. 5 - DECARBONISATION REPORT

- All components were satisfactory except the exhaust valve spindles, which had slight erosion on the contact surface (seating surface) however the seats in the cylinder head were found in satisfactory condition, hence both exhaust valve spindles renewed
- All piston rings were renewed
- Bottom-end bearing was found in good condition, and was reused.
- Cylinder liner honed.
- Cylinder liner was extracted and cooling water spaces inspected and cleaned. Liner 'O' rings were renewed.
- Connecting rod serrated, dye checked for cracks and none were found

#### Following are the calibrations taken and recorded after 24 485 hours

A) Measurements of old piston rings:

| Ring number   | 1                                  | 2                                  | 3                                  | 4                                |
|---|------------------------------------|------------------------------------|------------------------------------|----------------------------------|
| Axial clearance in piston                                   | Measured: 0.19<br>U.limit: 0.25    | Measured: 0.15<br>U.limit: 0.25    | Measured: 0.15<br>U.limit: 0.25    | Measured: 0.12                   |
| Radial thickness of piston rings after removing from piston | Measured: 10.45<br>New ring: 10.50 | Measured: 10.40<br>New ring: 10.50 | Measured: 10.45<br>New ring: 10.50 | Measured: 6.50<br>New ring: 6.50 |
| Butt clearance in existing liner                            | 2.80                               | 2.50                               | 2.50                               | 1.80                             |

B) Liner calibration – before honing:

| Position from top  | 1      | 2      | 3      |
|--------------------|--------|--------|--------|
| Measured port/stbd | 280.04 | 280.05 | 280.03 |
| Measured fwd/aft   | 280.05 | 280.03 | 280.04 |

C) Crank pin diameter (original 230.00 mm):

| Position           | Fwd    | Center | Aft    |
|--------------------|--------|--------|--------|
| Measured port/stbd | 229.99 | 230.00 | 230.00 |
| Measured T/B       | 229.99 | 230.00 | 230.00 |

D) Connecting rod ovality measured with bearing shells removed & bolts tightened to torque:

A-A = 241.96-241.97

B-B = 241.95

NOTE: Axis A-A is 2-5 degs. on each side of serrated edges. Axis B-B intersects axis A-A at 90 degs.

E) Connecting rod top-end bearing clearance (between pin & bush):

Original = 0.15 to 0.20 mm, measured = 0.16 mm (same pin & bush reused)

F) Axial clearances with new rings in existing piston:

|             |      |      |      |      |
|-------------|------|------|------|------|
| Ring number | 1    | 2    | 3    | 4    |
| Clearance   | 0.19 | 0.15 | 0.14 | 0.12 |

G) Liner calibration – after honing:

|                    |        |        |        |
|--------------------|--------|--------|--------|
| Position from top  | 1      | 2      | 3      |
| Measured port/stbd | 280.05 | 280.04 | 280.03 |
| Measured fwd/aft   | 280.05 | 280.04 | 280.04 |