THE MOST EFFICIENT 4-STROKE ENGINE IN THE WORLD
WÄRTSILÄ 31

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Introduction and contents

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### Wärtsilä 31 main technical data

<table>
<thead>
<tr>
<th></th>
<th>Diesel</th>
<th>Dual Fuel</th>
<th>Spark Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bore / Stroke (mm)</td>
<td>310 / 430 mm</td>
<td>310 / 430 mm</td>
<td>310 / 430 mm</td>
</tr>
<tr>
<td>Nom. Speed (rpm)</td>
<td>750</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>Max. Output/Cyl (kw)</td>
<td>610</td>
<td>550</td>
<td>550</td>
</tr>
<tr>
<td>BMEP (bar)</td>
<td>30.1</td>
<td>27.1</td>
<td>27.1</td>
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<tr>
<td>Charge air system</td>
<td></td>
<td>2-stage turbocharging + variable valvetrain</td>
<td></td>
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Wärtsilä 31 test engines

- Prototype engines of each type available for testing
- Full scale engine validation
- Performance optimizations
Main Components

- Single cylinder engine used for selecting major components
- Components chosen based on both performance and reliability
Fuel Injection System

• LFO and HFO capable common rail system, with the ability to run multiple injections per cycle

• Fuel injection rate shaping used to improve the NOx-BSFC trade-off
  • Slow rate shaping requires higher cylinder pressure. Taken into account in the design phase!
Twin needle injector

- Small injector nozzle for low smoke operation. Good atomization of fuel also at low rail pressure.
- With the small nozzle a better NOx-BSFC trade-off can be achieved due to more tuning freedom thanks to the lower smoke emissions.
Stepless VIC (Variable Inlet valve Closing)

- A key feature for optimizing the engine at all loads.
  - NOx, BSFC, EGT, Pmax, Smoke, ...
- Direct enabler for better part load performance
VEC (Variable Exhaust valve Closing)

- VEC is used to adjust the amount of scavenging
  - Another factor bringing more options for optimization
  - Low load running without reverse flow
Turbocharging & Automation

• 2-stage turbocharging with over 75% turbocharging efficiency

• UNIC 2 control system which enables the use of all new technologies
  • In-house development
Conclusions

• Excellent performance is gained by combining the right technologies, and having the engine designed for these technologies

• The Wärtsilä 31 is a clear step towards higher power density and efficiency

• The flexibility of the platform gives something to build on far into the future