Bergen B gas engine
...the power of experience
Tomorrow’s gas engine technology

Delivered today... cleanly, efficiently and profitably

Rolls-Royce, a leading global power systems company with an unrivalled track-record on land, at sea and in the air, began to focus on gas engine technology in 1984. Since then we have developed, manufactured and installed more than 600 lean-burn gas engines for industrial power stations and municipal uses. Today our products stand at the forefront of technology and quality.

Since we delivered our first gas engine in 1991 our engines have logged millions of operating hours in a broad range of applications and environments.

Today the latest generation of our B-gas engine still represents the future in terms of stringent emissions requirements, highest possible electrical and heat recovery, extreme reliability and high power. Based on the successful technology of the K-gas engine, today’s B-gas engine sets the standards to which all competitors aspire.
The world’s most efficient gas engine

The B-gas engine’s design philosophy is to achieve increasingly stringent exhaust emission standards, industry-leading electrical and heat recovery efficiency and high and dependable power levels to suit today’s and tomorrow’s applications.

This philosophy draws on over 60 years of reciprocating engine experience and the strengths of our very successful K-gas engine family, first delivered into service in 1991. We took the latest B32:40 hardware and redesigned and modified it for the demands of the gas engine market. We also embraced the best of K-gas combustion and governing technology. The outcome: today’s B-gas engine available in 9-cylinder in-line and 12V, 16V and 20V cylinder configurations.

Our philosophy also concentrates on continuous technological development to achieve new standards of higher power and efficiency in the 720 to 750rpm class. The results of this drive include the B-gas engine’s enlarged cylinder volume and optimised combustion technology, delivering class-leading performance without over-stressing the engine.

Gas engine power range

Tailored to match your needs
World-class performance

The profitable solution

- High Power Output
  - Fewer engines to install

- Strong Local Support
  - Quick response to minimise downtime

- Low Service and Maintenance Cost
  - Low cost per MWh

- Power Solutions Modular Design
  - Minimum engineering and purchase resources

- Maintenance Friendly
  - Reduced time for maintenance

- Local expertise

- Low fuel gas consumption
  - Low fuel gas consumption

- Gas technology from K-series

- Fewer engines to maintain

- Gas-powered engines

- State-of-the-art combustion technology

- Fewer cylinders to maintain

- Low lubricating oil consumption

- Low oil consumption

- Low fuel gas consumption

- Gas technology from K-series

- Low lubricating oil consumption

- Fewer engines to install

- Strong mechanical design

- High cylinder volume

- High efficiency

- High electrical efficiency
  - Low fuel gas cost

- High cylinder volume

- Strong mechanical design

- Long overhaul intervals

- Long-term service agreements

- Flexible systems

- Proven Technology
  - Proven and reliable

- High quality materials

- Strong mechanical design

- High design reliability

- Fewer cylinders to maintain
Worldwide capability, wherever you are

Many gas engine installations require heat recovery, whatever their applications. Our experience ranges from remote power supply to co-generation, tri-generation and CHP in climates ranging between the arctic freeze of Svarlbard and hot and humid Bangladesh.

Flexible and modular power plants installed in our own designed self-contained gas engine packages can be supplied with all the components and auxiliaries needed to construct a fully working power station. Flexibility is the key to this design as it allows operators to extend the station when the time is right by adding additional modules. Being a self-contained design it is a cost efficient solution to providing electrical power.

Our experience in the delivery, installation, commissioning and service of more than 600 lean-burn gas engines will benefit your plant.

Our core competence in gas engine delivery projects reflects our enormous experience with medium-speed engines across the full range of environments. This experience underpins the way our people and our technologies benefit customers worldwide – whatever the challenges involved.

And our experience in the service and operation of medium speed engines stretches worldwide. We undertake full service and maintenance contracts on most of our delivered gas engines, contracts that provide uniquely valuable feedback to our design and systems teams.

Our experience underpins your profitability
Experience that leads the world

Based on well-proven technology, the control system of the B-gas engine combines mechanically-operated gas valves with variable turbocharger geometry to control the air and gas flow. A limited number of electronic parts include cylinder selective knock and ignition control.

This set-up ensures a particularly good transient load response plus exceptional part-load performance, which are of key importance in island mode operation.

Our long experience with lean-burn gas engines and our far-reaching research programmes have created a refined combustion system that is the core element of the B-gas engine’s superior performance. Important aspects include the special inlet port design, the flame-deck layout and the piston-bowl shape. Combined with our proven pre-chamber technology, these benefits ensure quick and complete combustion under all operating conditions.

Also, the mechanically robust design of the B-gas engine – based as it is on our state-of-the-art engines with an excellent reliability record – includes advanced features such as nodular cast-iron structure, six studs per cylinder-head, strong-backed cylinder-head and liner and latest materials for bearings and valves.

High technology ensures low risk
The B-gas engine produces exceptionally low emissions of NOx, CO and UHC combined, a tribute to its efficient combustion technology that ensures minimum environmental impact coupled with improved performance.

Another advantage is its large cylinder volume. Because the specific power of gas engines is limited by gas and operating constraints, a large volume is needed to ensure high cylinder output. With its 350 mm/400 mm bore/stroke cylinders, the B-gas engine is the best in its class.

At the same time the engine’s combination of large components running at low rpm and optimised combustion and turbocharger technology ensure the highest efficiency.

The B-gas engine gives the widest power range in the 720-750rpm class.
Setting the highest standards

Cost-effective technologies are built into the B-gas engine

Exhaust system
Single-pipe MPC-type, optimised for high efficiency and reliable operation.

Gas admission and governing
The combination of a separate admission valve with an adjustable flow control valve ensures quick governing response and easy cylinder balancing.

Charge air receiver
This generous charge air receiver ensures low pressure losses, dampens out pressure fluctuations and provides good and equal air supply to each cylinder.

Ignition and controls
The B-gas engine’s ignition system exploits solid-state technology and provides individual timing and diagnosis for each cylinder, plus adjustable energy level. The ignition system works alongside a knock-detection system that monitors and adjusts each cylinder individually.

Camshaft
This has a simple, reliable design with individual cams shrunk onto a precision ground and segmented shaft. Cams can be changed individually.

Crankshaft
This is a single forging of specially alloyed steel. Identical to the B32:40 crankshaft, it complies with all marine classification rules. Its timing-gear drive is at the flywheel end.

Engine block
This advanced mono-block structure is high precision case in nodular iron for maximum strength and ease of repair. It contains charge air, cooling water and lube oil and drain channels.

Cost-effective technologies are built into the B-gas engine.
Main technical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tr>
<td>Bore</td>
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<tr>
<td>Stroke</td>
<td>400 mm</td>
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<tr>
<td>Cylinder configuration</td>
<td>9, 12, 16 and 20 cylinders</td>
</tr>
<tr>
<td>Speed</td>
<td>720-750 rpm</td>
</tr>
</tbody>
</table>

Technologies for long-term reliability

**Turbochargers**

The B-gas engine has two turbochargers, mounted back-to-back with one exhaust outlet. They have variable turbine geometry for ease and precision of air-flow control. This provides a simple and very efficient system that adjusts easily to varying operating or ambient conditions.

**Cylinder head**

Developed from the very successful B32:40 engine design, this features specially modified new ports, gas admission valves, special firing pressure indicators, a modified cooling bore layout and different flame deck machining.

**Pre-combustion chamber**

This small pre-combustion chamber of special heat-resistant steel is located centrally in the cylinder and optimised to ensure even and rapid distribution of ignition energy to the entire combustion space.

**Cylinder liner**

This is a development of the latest engine design using optimised materials, wall thickness and cooling-bore layout for gas operation.

**Piston and running-gear**

This well-proven steel/aluminium composite design features a special gas engine combustion bowl that ensures good cooling. Piston rings and cuff rings are all developed specifically for gas operation. The connecting rod is identical to the successful B32:40 design.
Enhancing the world’s environment

Lean-burn technology for cleaner, efficient power

Rolls-Royce has been a pioneer in the development of the modern lean-burn gas engine concept. Today we have extended the benefits of lean-burn technology even further in the B-gas engine.

Our world leading lean-burn gas engines are based on Otto principle, using Miller cycle in combination with Variable Turbine Geometry (VTG) to achieve optimized combustion. By using a strong ignition source and an optimized pre-chamber, the gas-air mixture in the cylinder can effectively be ‘leaned-out’ to reduce emissions and achieve improved engine performance.

These improvements include higher efficiency, lower emissions (particularly of nitrous oxides) and significantly increased specific power.
The difference is the way we achieve it

In the B-gas engine, the turbocharger supplies combustion air via the intercooler and the charge air manifold supplies air to individual cylinders. A timed mechanical gas valve injects gas into the inlet air stream, while the specially-designed inlet port and engine control system ensures a uniform and lean mixture of air and gas.

During the compression cycle, the lean mixture in the cylinder is partially pushed into the pre-chamber, where it mixes with pure gas to form a rich mixture easily ignited by the spark plug. Fast and complete combustion of the main mixture in the cylinder is ensured by a powerful ignition discharge from the pre-chamber and an optimised combustion chamber design.

All the time an advanced electronic control system ensures all operating parameters of the engine are adjusted and optimised to harmonise with each other.
The benefits of experience

Outstandingly robust, simple and straightforward design that’s easy to maintain and comes with a proven reliability record.

Limited number of service parts and items.

Good accessibility ensured by ample space, large covers and doors.

During service work only a limited number of hydraulic tools are needed, all of which are particularly safe and easy to use.

Regular maintenance checks, which are reduced to a minimum, are grouped within a few defined service stops. They enhance both running time and availability of your engine.

Our component exchange system removes any need for detail repair, reducing downtime and improving quality of work.

The well-established and experienced service network worldwide provides a comprehensive range of services, including efficiency and emission tune-ups and recalibration.

Besides controlling customers’ maintenance budgets and boosting availability and reliability, Long-Term Service Agreements provide flexible options to match all customers’ priorities.

Features to make life simpler
Rolls-Royce service and support embraces complete life-cycle support for your engine and equipment. We work with you to ensure engine and plant profitability and to protect your investment through our dedicated global network.

We know by experience how lifelong support for your investment means minimum down-time and low life-cycle costs, so we provide services that optimise your B-gas engine throughout its life.

Our Long-Term Service Agreements give you peace of mind, focusing on maximising your profitability and unit availability.

These include wide accessibility to original spare parts, regular on-site inspections, remote monitoring, technical support and computer-based training of personnel.

Our customers have always rated our total focus on effective and easy servicing extremely highly, a tribute to the work of our expert technical support and field personnel worldwide.

**Service to ensure your investment prospers**

**Our service network ensures:**

- Long-Term Service Agreements including guaranteed availability levels
- Safe running
- Quality parts
- Technical customer support
- Time and cost-effective support programmes
- Warranty
- Upgrades and modifications
- 24 hour a day support availability
In the real world, experience comes out on top

The Rolls-Royce range of Bergen engines combines outstanding technologies, global experience and unrivalled engineering excellence to benefit gas engine customers wherever you are, and to enhance the environment.

In the B-gas engine, we have developed a class-leading power unit that works tirelessly to provide energy markets with clean, reliable and cost-efficient power for the long-term benefit of communities worldwide.

As the world’s most efficient lean-burn gas engine, the B-gas also brings you the powerful benefits of high efficiency and low risk.

**Rolls-Royce B-gas**

It’s simple... it’s unbeatable and it’s in service

**Technologies designed to enhance your bottom line**
Your Powerful Partner

Rolls-Royce Power Systems AG with its headquarters in Friedrichshafen, Germany, is a specialist for large engines, propulsion systems and distributed energy systems.

We develop, produce and service engines, propulsion and energy systems marketed under the MTU and the MTU Onsite Energy brand names and also manufactured by Bergen Engines AS. They are used to drive ships, heavy land, rail and defence vehicles, to operate industrial facilities and to generate emergency, base load and peak load power. L’Orange supplies fuel injection systems for large engines.