



Rolls-Royce

501 Gas Turbines

Performance demonstrated by success

energy



Representación exclusiva en España:



SOLJET ENERGIA s.a.

Paseo de la Castellana 154, 1 Izq. 28046 Madrid

Teléfono: 91.458.77.32

Power proven in flight, trusted on

More than 2,500 Rolls-Royce 501 gas turbines have been supplied for industrial use, accumulating an impressive 65 million operating hours with 500 customers in 40 countries. This success is testimony to the efficiency, ease of maintenance and high availability delivered by the dependable 501 design.

The Rolls-Royce 501 gas turbine provides power output between 4.1 and 6.15 MW (5,500 and 9,050 HP) for applications such as pipeline transmission, gas storage and withdrawal, field gas compression and crude oil pumping, power generation for onshore and offshore, as well as combined cycle and cogeneration.

Based on the proven T-56 turboprop flight engine, recognized for its reliability in the Lockheed Martin C-130 Hercules transport aircraft, the industrial 501-K owes some of its key features to this aerospace heritage: lightweight modular

construction, ease of field repair, limitless starts and stops with the capability of using a wide range of fuels under any environmental condition.

The success of design flexibility

The single-shaft version, 501-KB, is designed for power generation and fixed speed mechanical drive applications. A two-shaft version, the 501-KC, is ideal for driving pumps and centrifugal compressors, which require a wider operating speed range. The boosted (KB7 and KC7) and unboosted (KB5 and

Operating benefits

Longer life – improved temperature profiles and uniform fuel injection.

More corrosion resistance – pin fin vanes incorporated into the first stage increase the cooling area effectiveness of the gas generator turbine vanes, with advanced coating material to provide superior oxidation and hot corrosion resistance.

Improved performance – turbine performance is improved due to improved flow path.

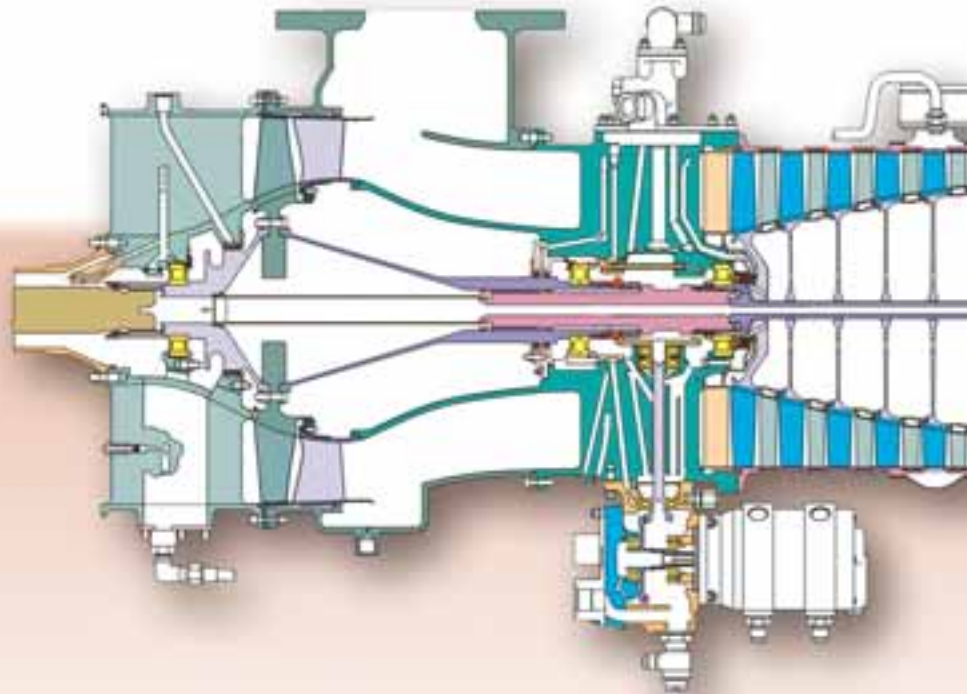
Extended life – state-of-the-art coating on turbine foils demonstrates longer life.

Updated design – low emission combustion liners designed to increase life of hot path components.

Low emissions across wide operating range – intrinsic to the proven Rolls-Royce Dry Low Emissions design, emissions on all 501-K models are held within a tightly controlled range throughout operating condition variations.

Efficient gas compression packages – high-efficiency Cooper-Bessemer pipeline compressors designed to match 501-K power and speeds.

API-Compliant – Built to stringent API-616 standards.





land and sea.

KC5) versions provide power capability between 4.1 and 5.5 MW (5,500 and 7,400 HP) for both power generation and mechanical drives.

The unboosted 501-K uses fourteen stages of compression to maximize flexibility of operation. The boosted versions utilize an additional compressor boost module in front of the main compressor to achieve higher mass flow and pressure ratios resulting in a power and efficiency boost. Compressor bleed valves assure safe starting and optimum performance over the entire load/speed range.

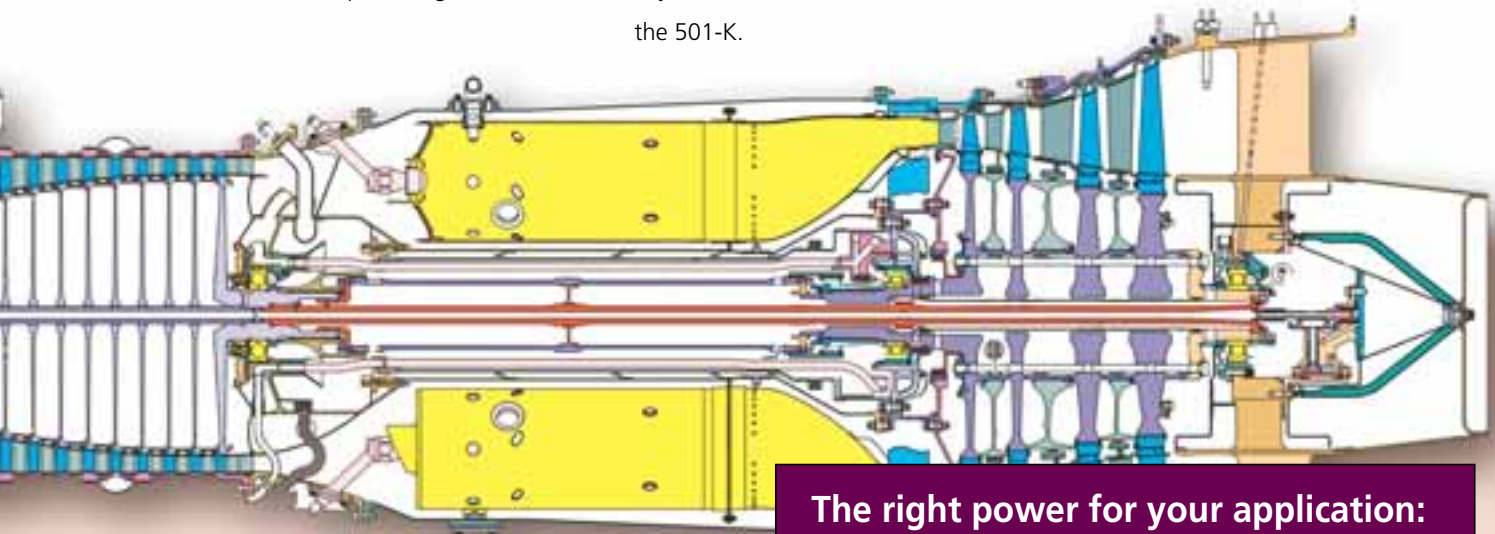
The first two turbine stages drive the gas generator. Two additional turbine stages provide power to drive generators, compressors and pumps. The steam-injected, single-shaft 501-KH5 provides power above 6.5 MW (9,050 HP) at an efficiency unprecedented for gas turbines of this size.

Fuel options

Six combustion cans, which can be fitted with a multitude of different fuel nozzles, allow operation on gas, liquid, dual fuel, low BTU fuels, steam and water injection. Dry Low Emissions (DLE) is available on the 501-K.

Compact design, common components.

The 501-K gas generator is typically less than 2.7 meters (8 feet) long and weighs less than 766 Kg (1,690 lbs.). This compact design offers application versatility, while 501 variants share a majority of common components to simplify maintenance and parts inventory.



The right power for your application:

<u>Model</u>	<u>KW</u>	<u>HP</u>
501-KB5	3,938(e)	–
501-KB7	5,300(e)	–
501-KC5	4,100	5,500
501-KC7	5,500	7,400
501-KH5	6,420(e)	–

Technology and experience drive continual improvements

As a global leader in the production of a broad line of turbines for critical applications as varied as aerospace, defense, and marine, as well as the energy industry, Rolls-Royce dedicates unmatched engineering and operating expertise to applying technology advancements to new and existing products.

Tempered by a healthy respect for the strong basic design advantages that are the foundation of the 501 gas turbine success, proven material and component advancements are continually applied to all 501 gas turbine models. Many of these enhancements are invisible to the operator, like advanced coating

materials on crucial parts to provide an even longer operating life.

Because the Rolls-Royce commitment to enhancing performance extends throughout our equipment's life cycle, technology-based updates are also available in retrofit format for 501 turbines currently in service.



Packaged for Success

Power generation applications

The 501-KB5 and the boosted 501-KB7 have demonstrated reliability in power generation applications for offshore platforms, onshore gas production, stand-by power and cogeneration.

Applications	<ul style="list-style-type: none"> Combined cycle, cogeneration, stand-by power, primary power.
Common Skid Design	<ul style="list-style-type: none"> Both 501-KB models packaged on the identical skid, same interfaces, for simple on-site switch of gas turbines. Economical on-site upgrade from 501-KB5 to 501-KB7 as power needs to be increased. All ancillary and auxiliary equipment identical on the common skid.
Gear	<ul style="list-style-type: none"> Epicyclic gearbox face mounted in the generator for a close-coupled solution impervious to misalignment. High-speed power output shaft directly connected to high-speed end of gearbox. Durable steel, easy internal inspection, same gearbox frame for both 501-KB models. Pre-designed gear wheel sets for 50 and 60 Hz reduce delivery lead times.
Driven Equipment	<ul style="list-style-type: none"> Generator – Typically open drip proof design and 4-pole construction. One frame size provides for both the rotor and starter of both 501-KB models. Alternator can be designed for frequencies, voltage and powers specific to project.

Compressor and pump drive applications

The 501-KC5 and the boosted 501-KC7 have a proven record of providing reliable power for driving compressors and centrifugal pumps in the oil and gas industry.

Applications	<ul style="list-style-type: none"> Pipeline transmission, gas storage and withdrawal, field gas compression, waterflood, crude oil pumping, for onshore and offshore.
Common Skid Design	<ul style="list-style-type: none"> Gas generator, power turbine and all auxiliary systems packaged on a single skid. Both 501-KC models packaged on identical skids with same interfaces. Quick field upgrades, simplified maintenance and operation, minimal spare parts inventory.
Connection	<ul style="list-style-type: none"> Flexible coupling between the power turbine and driven equipment designed to API-671. Couplings do not require lubrication, impose no excessive axial or radial loads.
Driven Equipment	<ul style="list-style-type: none"> Compressor – Cooper-Bessemer pipeline and barrel compressors designed to match 501 gas turbine power ratings. Highest efficiency pipeliner in the industry, Cooper-Bessemer RFA24, also available. Other manufacturer's compressors available.



Package features for all applications

Lubricating Oil System	<ul style="list-style-type: none">■ Provides synthetic oil to gas turbine, power turbine, gear and driven equipment for higher durability and longer life than mineral oil.■ Main lube pump driven off the turbine for normal operation and shutdown.■ Auxiliary pump for backup.■ Oil system components skid-mounted, designed to API-614 standards.■ Optional heaters/coolers to meet the climate needs of the application.
Fuel System	<ul style="list-style-type: none">■ On-skid fuel system includes all components needed to control fuel during start-up and operation.■ Operates on natural gas, liquid, dual fuel, low BTU, steam and water injection.
Low Emissions	<ul style="list-style-type: none">■ Dry Low Emission (DLE) system available on 501 variants; both power generation and mechanical drive applications.■ Maintains stringent emission levels across wide range of operating conditions.
Start Systems	<ul style="list-style-type: none">■ Emission-free start capability with on-skid VFD electric and hydraulic-electric start.■ Overrunning clutch disengages when self-sustaining speed is reached.
Baseplate	<ul style="list-style-type: none">■ Sturdy but small lightweight footprint.■ Design allows easy access for maintenance.■ Jib boom provides easy removal or installation of gas turbine.
Electrical & Plumbing	<ul style="list-style-type: none">■ Stainless steel on-skid piping and tubing improves corrosion resistance.■ All on-skid cabling wired to junction boxes; CSA, NEC and IEC standards can be observed.■ On skid instruments generally in accordance with Div.2 or Zone 2 classifications (depending on codes specified for project).
Air Intake System	<ul style="list-style-type: none">■ Provides clean, uniform airflow to gas turbine.■ Includes filter assembly, silencer and flow direction geometry■ Site-specific design minimizes disruption of inlet air.■ Filtration systems available to handle site extremes—arctic cold, water spray entrained with salt, severe heat and dust.■ Single to multiple stages handle offshore, coastal and inland sites.
Gas Turbine Enclosure	<ul style="list-style-type: none">■ Acoustic enclosures meet wide range of requirements and environments.■ Factory-completed enclosure can house all auxiliary equipment on turbine skid, with piping and wiring completed and tested at factory.■ Completed enclosures shipped with connections intact for simplified installation and commissioning.
Water Wash System	<ul style="list-style-type: none">■ Maintain performance by preventing build-up of contaminants in gas generator compressor.■ Pump or compressed air system includes storage tanks, pressure gauges, valves, piping.

Complete capabilities



Factory testing

Rolls-Royce has extensive test facilities in both North America and Europe to ensure that each unit conforms to exacting performance objectives. Each gas generator undergoes a full speed, full load test run at the Rolls-Royce facility. Then the packaged gas turbine is given a full speed, no load test run prior to shipment.

Operation full load dynamometer testing to ASME PTC-22 can be conducted using either liquid or gaseous fuel over the complete range of speeds and load of the 501 gas turbine family. Complete package full load and emissions string testing is also available. In this case the actual driven equipment (compressor, pump, or AC generator) is used for loading to ensure that all package performance objectives are met.

Automation and control systems

Rolls-Royce provides complete automation and control solutions for 501 gas turbines, including the En-Tronic® family of control systems as well as commercial (off-the-shelf) PLC's. En-Tronic programmable modules allow real time monitoring of gas turbine speed, sequencing, surge, governor and lubrication control.

Easy-to-use software permits the fine-tuning of set points and variables within the system memory. This allows control, start/stop and lead unit select routines and

loading/unloading steps to be programmed into the system to achieve operation at the lowest possible cost. Precise digital fuel control provides optimum fuel efficiency.

Availability is maximized using display, logging and maintenance information, which allows operators to evaluate unit history and plan shutdowns to coincide with other plant maintenance. En-Tronic



control systems are also available for load shedding for multiple power generation units and complete pipeline station controls for compressor drives.





Product support/customer services

Support services are provided through our dedicated Rolls-Royce customer services organization. Our worldwide technical staff and experienced engineers, as well as strategic location of inventoried spare parts, assure quick response time. Lease and exchange engines are available through our "power by the hour" program. Rolls-Royce also provides overhaul

and repair services through our joint venture, the Rolls Wood Group, as well as a number of affiliated authorized maintenance centers.

Solutions for the future

At Rolls-Royce, we are continually working today to increase the range and scope of customer service solutions in

order to meet tomorrow's challenges. A prime example of this commitment to the future is our on-line service community at www.energymanager-online.com which provides customers with access to our technical documentation every second of every day!

Training

Rolls-Royce has trained thousands of technical, engineering and support personnel in safe and economical methods for reducing downtime, increasing fuel savings and extending the life of their gas turbines, support systems and driven equipment. A training coordinator is assigned to work with the customer to develop, schedule and implement a complete, customized 501 training program. Training can be conducted at one of our dedicated training centers, at Rolls-Royce worldwide facilities, or at the equipment site.

501 maintenance centers



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Regional Sales Offices

Americas-North America

10255 Richmond • Suite 101
Houston, Texas 77042 • U.S.A.
Telephone: (713) 273-7700 • Fax: (713) 273-7777

Americas-South America

Av. Almirante Barroso 52, 9th Floor,
20031-000, Rio de Janeiro, Brazil
Telephone: (00) 55 21 2277 0100 • Fax: (00) 55 21 2277 0168

Asia Pacific

16 International Business Park
Unit 03-09, Singapore 609929
Telephone: (65) 6899 0092 • Fax: (65) 6862 4495

Europe/Middle East/Africa

5, Mondial Way • Harlington, Hayes
Middlesex UB3 5AR • United Kingdom
Telephone: 44 (0)20 8990 1900 • Fax: 44 (0)20 8990 1911

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