The TB5000 was designed for industrial duty, with the same philosophy as earlier Gas Turbines being applied, such as reliability. This gives the TB5000 the ability to run for long periods without change of major components allied to on-site maintenance capability.

The TB5000 offered proven reliability, with over 800 TB units of all types in worldwide operation which have accrued in excess of 20 million running hours.

The TB5000 delivers between 3.4 and 3.81MW ISO rating and its twin-shaft configuration provides for a wide range of power generation and mechanical drive applications in any environment.

The TB5000’s compact design and ease of operation and maintenance made it an ideal prime mover for offshore platforms and remote installations.

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Design Features

A heavy duty industrial gas turbine, the TB5000 offered the characteristics of high reliability and long life associated with well designed turbo machinery.

The TB5000 is a simple-cycle unit which consists of a 12-stage subsonic axial-flow compressor, a two-stage air-cooled overhung compressor turbine, four combustion chambers and a separate two-stage power turbine. The compressor features variable inlet guide vanes to modulate airflow and assure fast easy start-up and maximum efficiency under partial loads. The centre casing is split horizontally along the centre line providing access to the compressor with the minimum of dismantling.

The four reverse-flow tubular combustion chambers, externally mounted around the forward face of the centre casing assembly, are specially designed for long life and are readily accessible for inspection purposes.

The flexible fuel system is capable of operating on a wide variety of gaseous fuels including refinery gas, landfill gas and high CO2 content as, as well as distillate fuel, with automatic changeover form primary to secondary fuel possible across the entire load range.

The two-stage power turbine, with externally air-cooled discs, is aerodynamically coupled to the gas generator and provides power for the driven unit. Control System

To maintain alignment between rotating and static elements, the power turbine stator casing is attached to the gearbox through air-cooled support struts within the exhaust elbow. Compactness with rigidity is a feature of the power turbine assembly.

Flexibility

The highly responsive TB5000 offered unmatched reliability for base load electrical power generation and mechanical drive, onshore and offshore. A version of the TB5000 was also used as a prime mover in the Nomad 5, a compact, self contained, mobile power station designed to meet base load and peak electrical demands up to 3.8MW.

The TB5000 is well suited for cogeneration and combined cycle power applications. Using exhaust gas to generate steam for process use or supplementary power generation significantly increases the system efficiency.

Steam may also be used for injection into the TB5000 to increase the power output which also reduces heat rate and emissions. Options exist for emissions control by primary injection; power enhancement up to 4.2MW ISO by secondary injection and power enhancement with emissions control using both injection systems.

A fully integrated Siemens controls package suitable for all applications is available, offering high reliability and incorporating features to enhance engine and systems availability.

Options are available to provide control sequencing and monitoring of driven equipment and auxiliaries used in power generation, cogeneration and mechanical drive applications. The controls package may also be extended to cover data logging, plant supervisory control and financial management of complex power systems.

Texaco’s Tartan Field platform with 13 Siemens Gas Turbines installed; five to drive generators, two for main oil line pump drive, three to drive gas compressors and three to drive water injection pumps. Exhaust heat from the gas turbines driving the generators was recovered and used in the processing of the well gas.
Maintenance
The TB5000 has been designed for ease of on-site maintenance thereby maximizing operating availability and minimizing downtime.

Design features included:
- On-or-off site maintenance capability
- Horizontally split centre casing facilitates easy inspection of the compressor rotor and stator blades and turbine inlet support casing and bearings
- Using standard roll-out gear, the gas generator is easily removed from the turbine for blade inspection and overhaul
- Combustion chambers and fuel burners easily accessible if servicing is required
- Gas generator easily transportable by air in a custom built container

Planned inspection intervals of 8000 fired hours, or annually, with an intermediate inspection every third year or 24000 fired hours and major inspection every six years or 48000 fired hours, give low cost maintenance and high availability (Note: these inspections are designated A, B and C).

Servicing
The design of the gas turbine provides operators with the facility to carry out at site blade inspection and servicing of the unit or, at the operator’s choice, at a Siemens approved Service Centre.

Standard roll-out gear enables the gas generator to be simply removed from the turbine when blade inspection is due, or when servicing is required. With the gas generator removed, the rotating assembly is readily accessible by removing the top half of the stator casing. Combustion chambers and fuel burners are equally accessible when servicing is required.

Optional Equipment
A concept of standard optional equipment provides a wide range of proven, pre-engineered equipment. Modular fuel and lubricating oil systems are mounted away from the hot parts of the engine. Accessibly and conveniently located on the turbine base are all of the cable and pipe connections.

Standard output shaft speeds suit most available driven machines. A direct drive speed of 7900 rev/min is suitable for centrifugal pumps and compressors and with an integral epicyclic or parallel shaft gearbox, shaft speeds within the speed range of 1500 to 18,000 rev/min are provided.

Weights & Dimensions

<table>
<thead>
<tr>
<th>Base Engine</th>
<th>Length - 19’0” (5790 mm)</th>
<th>Height - 8’0” (2438 mm)</th>
<th>Width - 8’0” (2438 mm)</th>
<th>Weight - 30,000 lb (13,608 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator Set</td>
<td>Length - 32’0” (9753 mm)</td>
<td>Height - 8’0” (2438 mm)</td>
<td>Width - 8’0” (2438 mm)</td>
<td>Weight - 63,000 lb (28,577 kg)</td>
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<tr>
<td>Pump Set</td>
<td>Length - 26’0” (7925 mm)</td>
<td>Height - 8’0” (2438 mm)</td>
<td>Width - 8’0” (2438 mm)</td>
<td>Weight - 43,000 lb (19,505 kg)</td>
</tr>
<tr>
<td>Compressor Set</td>
<td>Length - 26’0” (7925 mm)</td>
<td>Height - 8’0” (2438 mm)</td>
<td>Width - 8’0” (2438 mm)</td>
<td>Weight - 57,000 lb (25,855 kg)</td>
</tr>
</tbody>
</table>

A Siemens TB5000 gas turbine driving a 3.3 MW generator at the pharmaceutical works of the Boots Company plc at Beeston, near Nottingham. The exhaust from the turbine was fed into a boiler which, with the provision of auxiliary firing, produced 60,000 lb/hr of process steam at a pressure of 340 psig. The installation achieved an efficiency well over 74%.
Normal Continuous Ratings

Altitude Correction Parameter

<table>
<thead>
<tr>
<th>Altitude</th>
<th>0m</th>
<th>500m</th>
<th>1000m</th>
<th>1500m</th>
<th>2000m</th>
<th>2500m</th>
</tr>
</thead>
<tbody>
<tr>
<td>δ</td>
<td>1.000</td>
<td>0.943</td>
<td>0.888</td>
<td>0.835</td>
<td>0.786</td>
<td>0.739</td>
</tr>
</tbody>
</table>

ISO Rating at 15 °C (59 °F) and Sea Level 4900. BHP output shaft speed 7900 rev/min.

The performance figures given are with zero inlet and exhaust duct and gearbox losses. Standard gearbox loss for indirect drive is 1.5%.

Inlet and exhaust ducting losses have not been debited. Power turbine speed 7950 rev/min.

Exhaust temperatures and Mass Flows are typical of current production engines.

Overall thermal efficiencies ranging from 55% to 90% are obtainable when using a gas turbine as the single power and heat source in an integrated manufacturing process. The curves show the variation of exhaust gas mass flow and temperature at sea level and different ambient temperatures.

Since the exhaust gasses are rich in unconsumed oxygen, auxiliary firing can be employed to increase the heat available by a factor of up to four or five to one depending on application.

Performance

Power and Specific Heat Input v Speed

Specific Heat Input is drawn for an ambient temperature of 15 °C but is approximately correct for other temperatures.

Direct drive - no output gearbox

Combined Heat & Power Systems

Generator Drive

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